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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Deer and Elk Use of a Ponderosa Pine Forest in Arizona Before and After Timber Harvest

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Animal use increased to almost six deer and elk per section per year on the cut watershed. During the same period, use on an adjacent uncut forest changed little. The new environment provided additional food while maintaining sufficient vegetation for cover.

The ponderosa pine forest, comprising approximately 9 million acres, is a major wildlife habitat in Arizona and New Mexico. It is found between elevations of 5,500 to 8,500 feet, and is inhabited seasonally by deer and elk. Management practices that alter the plant communities in the pine forest also affect its animal life.

Wildlife managers need information on how timber harvesting affects the distribution and abundance of game animals. From information provided by research, administrative guidelines can be developed for multiple use coordination with timber management on wild lands. This Note reports the first 4 years of a long-term study designed to evaluate the effects of timber management on wildlife.

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Literature Review

Timber harvesting has been recommended more than other techniques to create or maintain wildlife habitat. The cutting of timber does two things: First, herbage production is increased for several years after a reduction in overstory; and, second, a more diversified habitat is created.

Several examples suggest how overstory reduction increases herbage production. Browse in loblolly pine[2] varied from 90 pounds per acre under light thinning to 137 pounds with heavily thinned stands (Blair 1960). Herbage increased from 75 pounds with 100 percent tree cover to 425 pounds at 20 percent cover in the pine-hardwood forests of Texas

[2]*Common and scientific names of plants and animals mentioned are listed on p. 7.*

(Halls and Schuster 1965). Other studies[3,4] (Cook 1939, Westell 1954, Pase and Hurd 1957) show a similar relation between overstory reduction and increased herbage production.

Some information is available on the time required for herbage production on logged areas to revert to prelogging conditions. On the Kaibab National Forest, production of herbage peaked at 6 years after cutting and then started to decline. After 15-20 years, it was about the same as on an uncut area (Reynolds 1962). In the redwood region of northern California, deer reached a high from 5 to 10 years after cutting, then declined until 20 years after cutting when the forest reached a tall shrub stage (Dasmann 1964).

Deer are considered a product of a subclimax forest, and plant succession can be manipulated to benefit them by rotational forest cutting (Leopold 1949). Large blocks of cutover land, while valuable for wildlife, do not have as great a value as smaller units that produce more miles of forest edge (Gabrielson 1936). In Arizona, deer and elk seem to prefer small openings of less than 20 acres in spruce-fir habitat (Reynolds 1966).

Study Watersheds

The Castle Creek watersheds (East and West Forks) are located at approximately 8,000-foot elevation, 12 miles southwest of Alpine, Arizona. The watersheds were designated as research areas in 1955 to determine how methods of harvesting ponderosa pine affect water and sediment yields. West Fork watershed (treatment) contains 900 acres and East Fork (control) has 1,163 acres.

Overstory vegetation in West Fork is principally ponderosa pine with an understory of Gambel oak. Douglas-fir, true firs, southwestern white pine, and quaking aspen are found on the cool, moist, north-facing slopes.

[3] *McGinnies, B. S. The effects of forestry cutting practices on the production of deer browse in the Virginia pine (Pinus virginiana) type. 71 pp. 1949. (Unpublished master's thesis on file at Penn. State Coll., Univ. Park.)*

[4] *Patton, David R. The influence of forest cutting on browse availability. 57 pp. 1963. (Unpublished master's thesis on file at Va. Polytech. Inst., Blacksburg.)*

Browse species include Gambel oak, quaking aspen, Fendler ceanothus, and New-Mexican locust. Mountain muhly, Junegrass, and bottlebrush squirreltail are the characteristic grasses. Common forbs present are horse cinquefoil, western yarrow, and RockyMountain iris.

Game species indigenous to the area are mule deer, white-tailed deer, Rocky Mountain elk, black bear, Merriam's turkey, Abert squirrel, red squirrel, and cottontail rabbit.

The watersheds are in Arizona Game Management Unit 1A. Deer kill data from this unit indicate a steady decline in numbers from 1961 (42 percent hunter success) to 1967 (18 percent hunter success). Deer and elk move into or through Castle Creek in April and May. Snow conditions drive the animals onto the adjacent, but lower, Blue Range Primitive Area in late October or November. Only in very mild weather could Castle Creek be used as winter range.

Sampling Design

The forest was inventoried by watershed research in 1964 by means of a systematic sample with random starts. Sixteen transects were installed in each watershed with sample points spaced at 440-foot intervals. Each transect had from 25 to 50 points, for a total of 186 points in West Fork and 178 in East Fork.

The identification stake at each point was used as a center for different-sized circular plots to count browse plants and pellet groups, and to clip herbage. Browse was considered to be plants from 1 to 4.5 feet in height. Plants were counted (July 1964 and July 1968) on 69 square-foot plots. Herbage on one 9.6-square-foot plot was clipped at the same time.

Deer and elk pellets and cow chips were counted on 1/100-acre plots before and after the timber harvest. Pellets found in the first count (August 1964) were deposited over an unknown period, and were used only to delineate possible concentration areas.

Logging was begun in West Fork watershed in October 1966 and was completed by August 1967. The cutting method emphasized removal of poor risk and overmature trees. Trees over 11 inches d.b.h. were reduced from 45 to 12 per acre. One-sixth (150 acres) of the watershed was clearcut in

patches from 2 to 32 acres (fig. 1). The remaining acreage is in thinned stands of saplings (1 to 3 inches d.b.h.) and poles (4 to 11 inches d.b.h.).

Two pellet counts were made after the timber harvest. One count was in October 1967. Deer pellet groups from this count were not over 6 months old, and were converted to a per-year basis. The elk pellet groups had been covered by snow and were considered to be 1 year old. The other count was in October 1968. Groups from both years were plotted as an isogram to delineate use areas. Any area over 50 acres with 6 days use per acre per year (78 pellet groups, 10.5 animals per section) was accepted as a concentration area.

Wildlife observations were recorded throughout each year by U. S. D. A. Forest Service personnel working in the watersheds. Intensive surveys were made in October of 1965, 1967, and 1968 by wildlife technicians working on the pellet transects.

Results

In 1964, before logging, one deer pellet accumulation area of approximately 80 acres (8.8 percent of the watershed) was found in West Fork on a south-facing slope where Gambel oak and New-Mexican locust were available as browse. An average of 561 pellet groups per acre were deposited at this site, compared to 83 pellet groups per acre for the surrounding area. Since the pellets had accumulated over an unknown period, the days use per acre was not estimated.

There was no large accumulation of elk pellets in either watershed before the timber harvest. From a topographic map and isogram, it was evident cow chips were concentrated on areas of less than 15 percent slope.

A pellet count, 2 months after logging was completed in August 1967, showed the most deer groups per acre to be on the same concentration area as in 1964. Days use per acre was estimated to be 2.05 as compared to 1.50 for the rest of the watershed.

Fourteen months after the timber harvest, days use per acre on the 80 acres increased from 2.05 to 7.69—a change of 5.64 days use or 9.9 deer per section per year. At the same time the surrounding 820 acres showed an increase from 1.50 to 2.60 days use per acre, or 1.9 deer per section. There were not enough cow chips after the timber harvest to form an isogram.

Average days use per acre for deer in West Fork watershed in October 1967 was 1.58 (table 1). Days use increased to 3.26 by October 1968—a change of 2.9 deer per section. The adjacent uncut watershed (East Fork) had 0.70 days use in 1967 and 0.67 days use in October 1968.

Elk days use increased from 0.28 in October 1967 to 1.93 days use per acre in 1968 for an increase of 2.7 elk per section in West Fork. East Fork showed an increase from 0.18 to 0.71 days use per acre—less than 1 animal per section.

Herbage production in July 1968 increased over 100 percent from pre-cut conditions, exclusive of forage consumed by wildlife:

	Herbage production	
	July 1964	July 1968
	(Pounds per acre)	
Forbs	30	90
Grass	50	70
Total	80	160

Grass production includes both native plants and those established by seeding logging roads and skid trails. The increase in forbs was all from native plants. After the timber harvest, the number of browse plants increased from 525 to 820 per acre:

	Browse plants	
	July 1964	July 1968
	(Number per acre)	
Fendler ceanothus	30	120
Gambel oak	305	540
New-Mexican locust	155	70
Quaking aspen	35	90
Total	525	820

The browse available was almost entirely from new plants or sprouts. Of the four species, only New-Mexican locust did not increase.

Wildlife observations indicate there are two main periods of use in Castle Creek. Deer and elk move through the watersheds on their way to summer range in May and June. Days use during this

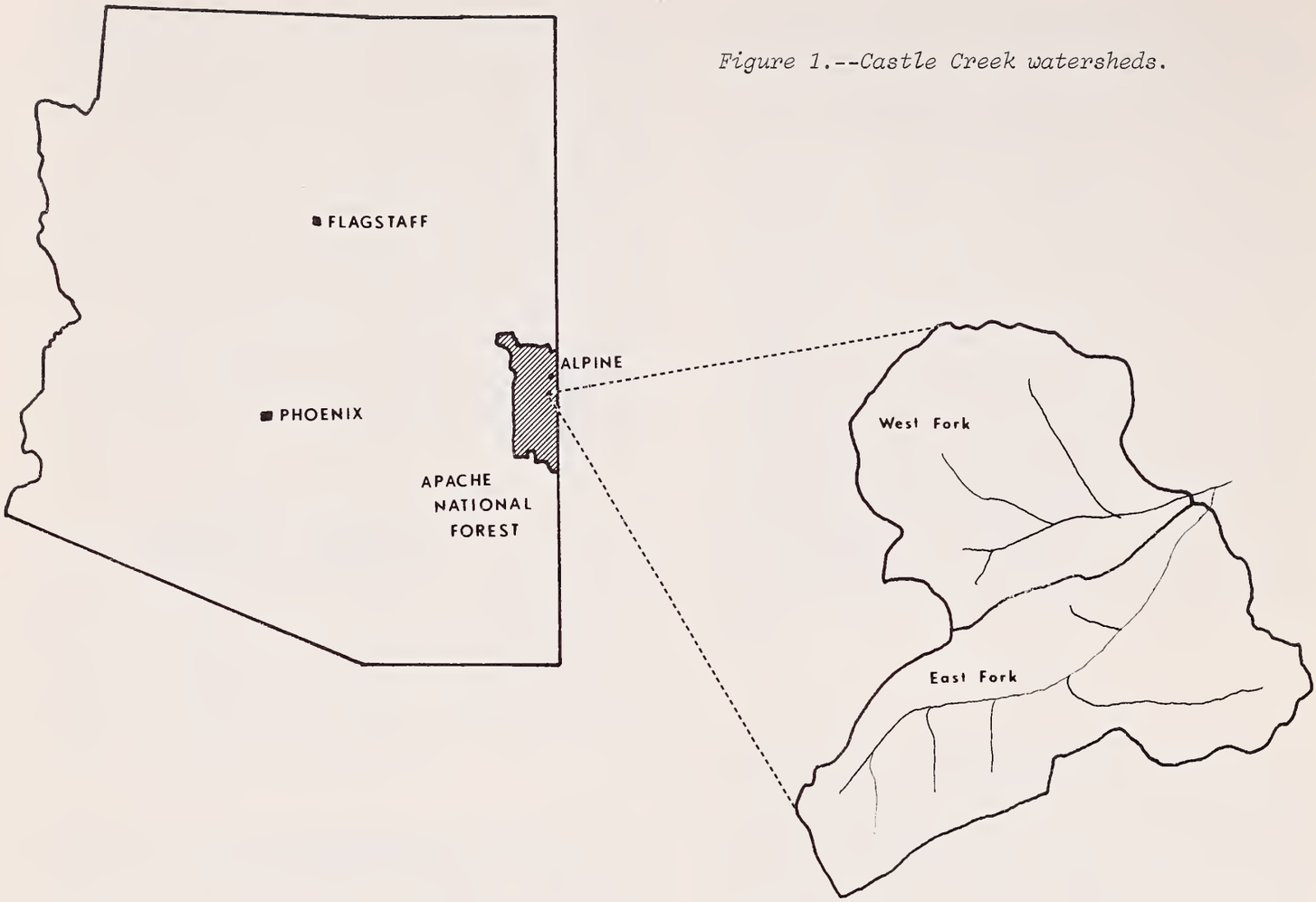
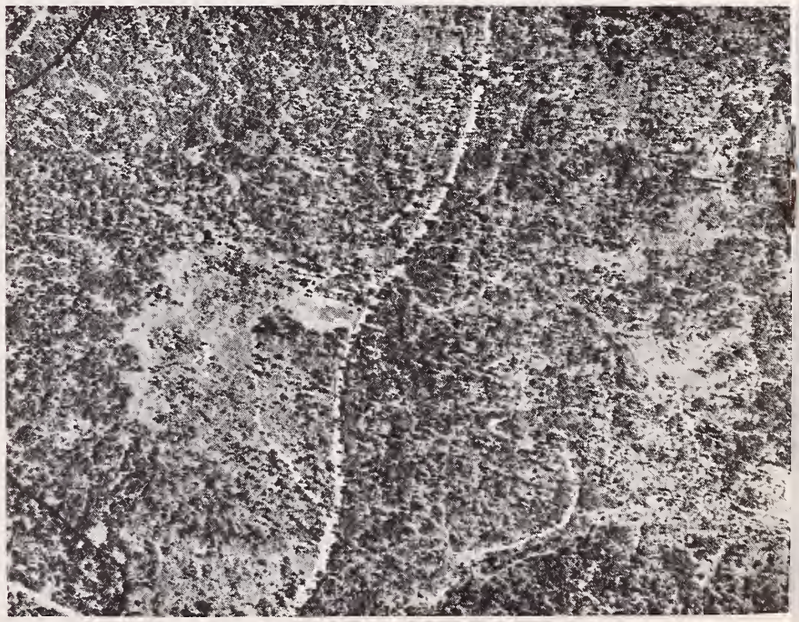


Figure 1.--Castle Creek watersheds.

AERIAL PHOTOGRAPHS OF WEST FORK WATERSHED

Prior to timber harvest

Following timber harvest



WEST FORK WATERSHED
(CAMERA POINT 3):

Prior to timber harvest

2 months following timber harvest

1 year following timber harvest

Table 1.--Deer and elk days use per acre on West (cut) and East Fork (uncut) watersheds

Date of pellet count and changes observed	West Fork (timber harvested August 1967)		East Fork (uncut)	
	Deer	Elk	Deer	Elk
	- - - Days use per acre per year - - -			
October 1967	1.58	0.28	0.70	0.18
October 1968	3.26	1.93	0.67	0.71
Difference	+1.68	+1.65	-0.03	+0.53
	- - - Number animals per section - - -			
Difference	+2.9	+2.7	-0.5	+0.8

period probably does not exceed one-half day per acre. A few animals remain in the watershed during the summer months. By October, deer and elk again move into Castle Creek, lingering there until the snow drives them onto lower winter range.

Discussion

The data from West Fork of Castle Creek indicate that timber harvesting has had a beneficial effect on deer and elk up to 14 months after cutting. An increase in days use per acre is associated with an overstory reduction followed by an increase in browse, forbs, and grasses.

Animal use increased to almost six deer and elk per section per year on the cut watershed. During the same period, use on an adjacent uncut forest changed little. Pellet accumulations on a south-facing slope increased to 10 deer per section on an 80-acre area. Observations in the watershed indicate that use is highest during October-November.

The timber harvest in West Fork has created a diverse environment from a monotonous habitat by separating the forest into small openings with scattered stands of saplings, poles, and sawtimber. The new environment has provided additional food while maintaining sufficient vegetation for cover.

The benefits also have been extended to hunters who have found easy access and good hunting conditions in the cut area. Even though the increased deer and elk use is for a short season, it coincides with the fall hunting. In 1967, four deer and one elk were harvested within the 900-acre, cut watershed.

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COMMON AND SCIENTIFIC NAMES OF PLANTS AND ANIMALS MENTIONED

Plants

Aspen, quaking	*Populus tremuloides* Michx.
Ceanothus, Fendler	*Ceanothus fendleri* A. Gray
Cinquefoil, horse	*Potentilla hippiana* Lehm.
Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco
Firs, true	*Abies* spp.
Iris, RockyMountain	*Iris missouriensis* Nutt.
Junegrass	*Koeleria cristata* (L.) Pers.
Locust, New-Mexican	*Robinia neomexicana* A. Gray
Muhly, mountain	*Muhlenbergia montana* (Nutt.) Hitchc.
Oak, Gambel	*Quercus gambelii* Nutt.
Pine, loblolly	*Pinus taeda* L.
Pine, ponderosa	*Pinus ponderosa* Lawson
Pine, southwestern white	*Pinus strobiformis* Engelm.
Squirreltail, bottlebrush	*Sitanion hystrix* (Nutt.) J. G. Smith
Yarrow, western	*Achillea lanulosa* Nutt.

Animals

Bear, black	*Ursus americanus amblyceps* Baird
Deer, mule	*Odocoileus hemionus crooki* (Mearns)
Deer, white-tailed	*Odocoileus virginianus couesi* (Coues & Yarrow)
Elk, Rocky Mountain	*Cervus canadensis nelsoni* V. Bailey
Rabbit, cottontail	*Sylvilagus nuttallii pinetis* (J. A. Allen)
Squirrel, Abert	*Sciurus aberti aberti* Woodhouse
Squirrel, red	*Tamiasciurus hudsonicus mogollonensis* (Mearns)
Turkey, Merriam's	*Meleagris gallopavo merriami* Nelson

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